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Structure and magnetic properties of nanostructured Pd-Fe thin films produced by pulse electrodeposition

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Abstract

Nanostructured Pd-Fe thin films with varied Fe content were prepared by electrodeposition technique from organic electrolytes on Cu and brass substrates. The structure and the magnetic properties of the films were investigated prior to post-deposition annealing. The structure of the Pd 1-xFe x thin film with x = 0.14, 0.24, and 0.52 was determined by X-ray diffraction (XRD) and transmission electron microscopy (TEM) as a solid solution of iron in palladium face-centered cubic lattice with the (111) orientation of nanograins relatively to the substrate surface. The films with higher iron concentration, x = 0.74, 0.91, have structure of a solid solution based on the body-centered cubic lattice. The average grain size determined by the scanning electron microscopy (SEM) for the first two alloys is 7-10 nm, and for the latter ones it is about 120 nm. The saturation magnetization of the films has linear dependence on the iron content, but coercivity has non-monotonic dependence on x, i.e., the films with x = 0.68 show highest coercivity. The magnetic anisotropy of the samples is studied by ferromagnetic resonance (FMR) spectroscopy.

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Keywords

Electrodeposition, Magnetic Properties, Nanocrystalline Pd-Fe Thin Films